WHAT IS CLAIMED IS:

1. A method of forming a nitride layer on at least one metal or metal alloy biomedical device, comprising: providing a vacuum chamber with at least one biomedical device positioned thereon on a worktable within the vacuum chamber; reducing the pressure in the vacuum chamber; introducing nitrogen into the vacuum chamber so that the pressure in the vacuum chamber is about 0.01 to about 10 milli-Torr; generating electrons within the vacuum chamber to form positively charged nitrogen ions; providing a negative bias to the worktable so that the positively charged nitrogen ions contact the biomedical devices under conditions such that a nitride layer forms on the at least one prosthetic device.

2. The method of claim 1, wherein the biomedical device is made of Ti-6Al-4V alloy, Ti_6Al_7Nb, commercially pure titanium, or CoCrMo alloy.

3. The method of claim 1, wherein the bias of the worktable is maintained to provide a temperature of about 700 and about 900 degrees Centigrade.

4. The method of claim 1, wherein the nitride layer has a thickness of at least about 1 micron.

5. The method of claim 1, wherein the worktable has a negative bias voltage of about 100 to about 2000 volts.

6. The method of claim 1, wherein the electrons are generated using a filament.

7. The method of claim 1, wherein the vacuum chamber is reduced to a pressure of less than 10^{-5} Torr prior to introduction of the nitrogen.

8. The method of claim 1, wherein nitrogen and an inert gas are introduced into the vacuum chamber.

9. The method of claim 1, wherein the nitride layer has a thickness of about 1 to about 4 microns.

10. The method of claim 1, wherein the nitride layer has a thickness of about 3 to about 4 microns.

11. The method of claim 1, wherein the nitrogen ions impact the biomedical devices omnidirectionally.

12. The method of claim 1 wherein the temperature is at least about 300 degrees Centigrade.

13. The method of claim 1, wherein the biomedical device contains titanium.

14. The method of claim 13, wherein the temperature is at least about 800 degrees Centigrade.

15. The method of claim 1, wherein the biomedical device contains cobalt.

16. The method of claim 1, wherein the temperature is at least about 650 to about 750 degrees Centigrade.

17. The method of claim 1, wherein the pressure is reduced to less than 10^{-5} Torr prior to introduction of the nitrogen.

18. The method of claim 1, wherein the pressure is reduced to less than 10^{-6} Torr prior to introduction of the nitrogen.

19. The method of claim 1, wherein the electrons are generated using a alternating current power supply.

20. The method of claim 1, wherein the worktable is biased using a direct current power supply.

21. An apparatus for forming a nitride layer of at least about 1 micron on a biomedical device, comprising: a vacuum chamber, at least one source of electrons, at least one nitrogen inlet, at least one worktable having a negative voltage bias, wherein the vacuum chamber contains nitrogen at a pressure of about 0.01 to about 10 milli-Torr.

22. The apparatus of claim 21, wherein the source of electrons is a filament.

23. The apparatus of claim 21, wherein the negative voltage bias is about 100 to about 2000 volts.

24. A biomedical device made of metal or metal alloy which comprises an outer nitride layer having a thickness of at least 1 micron.

25. The device of claim 24, wherein the nitride layer is 3 to 4 microns thick.

26. The device of claim 24, wherein the biomedical device is made of Ti-6Al-4V alloy, Ti_6Al_7Nb, commercially pure titanium, or CoCrMo alloy.